

THRESHOLD VOLTAGE ROLL-OFF COMPENSATION USING
BACK-GATED MOSFET DEVICES FOR SYSTEM HIGH-
PERFORMANCE AND LOW STANDBY POWER

ABSTRACT OF THE DISCLOSURE

A method for compensating the threshold voltage roll-off using transistors containing back-gates or body nodes is provided. The method includes designing a semiconductor system or chip having a plurality of transistors with a channel length of L_{nom} . For the present invention, it is assumed that the channel length of these transistors at the completion of chip manufacturing is L_{max} . This enables one to set the off-current to the maximum value of $I_{off_{max}}$ which is done by setting the threshold voltage value to $V_{t_{min}}$. The $V_{t_{min}}$ for these transistors is obtained during processing by using the proper implant dose. After manufacturing, the transistors are then tested to determine the off-current thereof. Some transistors within the system or chip will have an off-current value that meets a current specification. For those transistor devices, no further compensation is required. For other transistors within the system or chip, the off-current is not within the predetermined specification. For those transistors, threshold voltage roll-off has occurred since they are transistors that have a channel length that is less than nominal. For such short channel transistors, the threshold voltage is low, even lower than $V_{t_{min}}$, and the off-current is high, even higher than $I_{off_{max}}$. Compensation of the short channel transistors is achieved in the present invention by biasing the back-gate or body node to give increased threshold voltage about equal to $V_{t_{min}}$ and hence an off-current that meets the predetermined specification, which is about equal to $I_{off_{max}}$.